

A Systematic Revision of “*Barbodes*” Fishes in China

CHEN Xiao-yong¹, YANG Jun-xing

(Department of Systematic Zoology, Kunming Institute of Zoology, the Chinese Academy of Sciences, Kunming 650223, China)

Abstract: The genus *Barbodes* Bleeker is a catchall group. The species assigned to this genus in China actually belong to at least four distinct genera. After comparing all the *Barbodes* fishes included in this research to the system used by Rainboth, reassign *Barbodes* fishes in China as following: ① *B. baoshanensis*, *B. benasi* and *B. heterostomus* are assigned to genus *Neolissochilus*; ② *B. parvus* are assigned as *Discherodontus parvus*; ③ *B. pierrei* in Yunnan is conspecific with *B. vernayi* and *B. vernayi* should be assigned to the genus *Hypsibarbus* as *Hypsibarbus vernayi*; ④ the remaining *Barbodes* fishes, *B. fuxianhuensis*, *B. chonglingchungi*, *B. margaritanus*, *B. huangchuchieni*, *B. cogginii* (= *B. daliensis*), *B. rhomboides*, *B. carinatus*, *B. opisthopterus* and *B. exiguus* are assigned to genus *Poropuntius*.

Key words: *Barbodes*; *Neolissochilus*; *Discherodontus*; *Hypsibarbus*; *Poropuntius*; Taxonomy

中国“四须鲃”类的系统整理

陈小勇¹, 杨君兴

(中国科学院昆明动物研究所, 云南 昆明 650223)

摘要: 四须鲃属是一个“大口袋”类群。中国的四须鲃实际上分属于至少 4 个不同的属。通过与 Rainboth 的分类系统比对应之后, 对中国四须鲃属鱼类的分类系统重新进行了以下的修订: ①保山四须鲃、软鳍四须鲃和异口四须鲃归入新光唇鱼属; ②小四须鲃归入盘齿鲃属; ③分布于云南的高体四须鲃实为大鳞四须鲃, 大鳞四须鲃应归入高须鱼属; ④其余四须鲃属鱼类, 抚仙四须鲃、常氏四须鲃、太平四须鲃、云南四须鲃、颌突四须鲃 (= 洱海四须鲃)、鲂形四须鲃、梭四须鲃、后鳍四须鲃和油四须鲃均归入吻孔鲃属。

关键词: 四须鲃; 新光唇鱼; 盘齿鲃; 高须鱼; 吻孔鲃; 分类

中图分类号: Q959.468 **文献标识码:** A **文章编号:** 0254-5853(2003)05-0377-010

Fishes of the genus *Barbodes* Bleeker (1859), usually called as barbs, are widely distributed in India, Myanmar, Thailand and Africa. They are identified by the following characters: two pairs of developed barbels; mouth terminal or subterminal; lips simple, lower lip and lower jaw not separated, lower lip not reduced medially; branched dorsal rays 8-9, last unbranched dorsal ray osseous and serrated posteriorly in most species, smooth and non-osseous in a few

species; pharyngeal teeth in three rows. Until 2000, 16 species were classified as *Barbodes* in China (Shan et al, 2000). Except for the one species restricted to Guizhou, 15 species have been recorded in Yunnan and Tibet (Fig.1). Four species occur in lakes and 12 species occur in seven rivers, and most of them are commercial fishes in local area.

From 1878 to 1962, five species of “*Barbodes*” were described as *Barbus*, a generic taxon usually only

Received date: 2003-03-18; Accepted date: 2003-07-09

Foundation item: This research was funded by the Important Directional Project of Knowledge Innovation Program of the Chinese Academy of Sciences (KSCX2-1-06A), the National Natural Science Foundation of China (30070095), the Natural Science Foundation of Yunnan Province (98C028Q), and the Selected Foundation of Kunming Branch, the Chinese Academy of Sciences.

1. 通讯作者 (Corresponding author), E-mail: chenxy@mail.kiz.ac.cn. Tel: 0871-5191652

收稿日期: 2003-03-18; 接受日期: 2003-07-09

基金项目: 中国科学院知识创新重要方向项目 (KSCX2-1-06A); 国家自然科学基金资助项目 (30070095); 云南省自然科学基金资助项目 (98C028Q); 中国科学院昆明分院择优基金

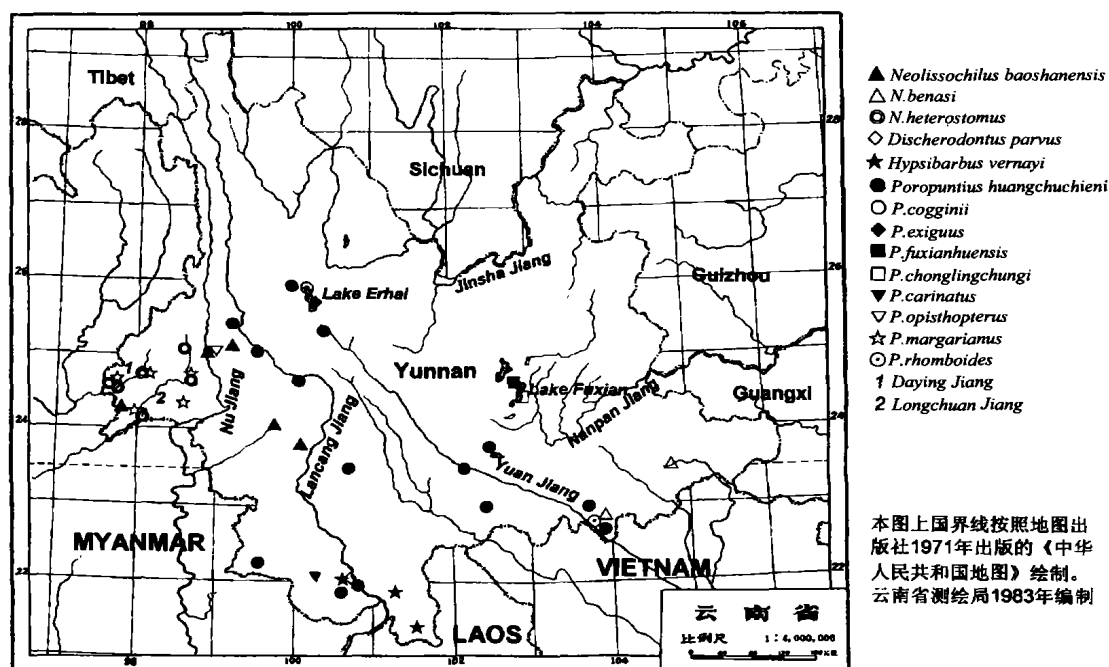


Fig.1 Distribution of "Barbodes" fishes in Yunnan, China

applied to fishes in Europe and Africa and, at present, in Yunnan. They are *Barbus margaritanus* (Anderson 1879; = *Barbodes margaritanus*) from Nantou River, *Barbus cogginii* (Chaudhuri 1912) and *Barbus gregori* (Norman 1923; = *Barbodes daliensis*) from Lake Erhai, *Barbus chonglingchungi* (Tchang 1936; = *Barbodes chonglingchungi*) from Jiangchuan? (Considering its years' distribution records, it is most likely from Lake Fuxian) and *Barbus huangchuchieni* (Tchang 1962; = *Barbodes huangchuchieni*) from Xishuangbanna. Wu et al (1977) described ten new species and subspecies, *Barbodes* (*B.*) *shanensis carinatus* from Menga, *Barbodes* (*B.*) *parva* from Jinghong, *Barbodes* (*B.*) *daruphani luosuoensis* (= *Barbodes vernayi*) from Luosuojiang, *Barbodes* (*B.*) *lacustris* (= *Barbodes chonglingchungi*) from Lake Fuxian, *Barbodes* (*B.*) *opisthopectus* from Nu Jiang, *Barbodes* (*B.*) *huangchuchieni rhomboids* (= *Barbodes rhomboids*) from Yuan Jiang, *Barbodes* (*B.*) *exigua* from Xizhou of Dali, *Barbodes* (*B.*) *daliensis* (= *Barbus cogginii*) from Xiaguan, *Barbodes* (*B.*) *wynadensis* (= *Barbodes baoshanensis*) from Baoshan and *Barbodes* (*B.*) sp. (= *Barbodes heterostomus*) from Muotuo, Tibet. Wang et al (1982) described *Puntius fuxianhuensis* (= *Barbodes fuxianhuensis*). Chu & Cui (1989) recorded *Barbodes benasi* from Hecou, Xichou, and *B. hexagonolepis* (= *Barbodes*

heterostomus) from Longchuan Jiang and Daying Jiang. Chen et al (1999) made an extensive review of *Barbodes* of Yunnan and described *B. heterostomus* from the upper Irrawaddy and *B. baoshanensis* from the Nu Jiang and Irrawaddy.

Among these 16 species, the population occurring in Longchuan Jiang and Daying Jiang was already shown to be a new species, *Barbodes heterostomus* instead of *Barbodes hexagonolepis*, and the relationship between the populations of *Barbodes* sp., which was considered as *B. hexagonolepis* in Shan et al (2000), in Motuo, Yaluzangbujiang, Tibet and *B. hexagonolepis* in the Brahmaputra is awaiting future study (Chen et al, 1999). The species in Guizhou, *Barbodes laticeps* (Lin & Zhang, 1986) is excluded from this research after one specimen from Huishui, Guizhou, was examined and the following characters suggested this species was quite different from those "Barbodes" fishes in Yunnan: body rounded, only slightly compressed; last unbranched dorsal ray smooth and non-ossaceous; branched dorsal ray 7 - 8; upper jaw and upper lip separate medially with a deep furrow and connected at mouth corner; upper lip not covered by rostral cap, with a shallow fimbriated prefringe; lower lip reduced medially and separated from lower jaw by a prominent shallow furrow. This species is somewhat similar to both fishes of the subfamilies Barbinae and

Labeoninae and probably represents a new taxon linking the Barbinae and Labeoninae and should be studied in the future.

The taxonomy of species of *Barbodes* varies among different ichthyologists. *Systomus*, *Barbus* and *Puntius* are also used for *Barbodes* fishes. *Systomus* McClelland, 1839 was considered as a synonym of *Barbus* (Eschmeyer, 1998), a synonym of *Puntius* (Banarescu, 1997), or valid, for a subset of fishes previously named as *Puntius* (Rainboth, 1996b). *Puntius* is still considered as valid by most ichthyologists (Jayaram, 1981; Roberts, 1989; Rainboth, 1991; Shan, 2000; Kottelat, 2001a, b). *Barbodes* Bleeker, 1860 was taken as a subgenus of *Systomus* originally with *Systomus* (*Barbodes*) *belinka* as the type. *Barbodes* was considered as a synonym of *Puntius* (Roberts, 1989), but most ichthyologists still consider *Barbodes* as valid (Wu et al, 1977; Chen & Chu, 1985; Chu & Cui, 1989; Kottelat, 1989; Rainboth, 1996b; Doi, 1997). However, the fishes using this name by these ichthyologists are different from the fishes in China. That is, none of the species named as “*Barbodes*” in China fit the revised diagnosis of *Barbodes* (Rainboth, 1996b): serrated dorsal-fin spine; 8 branched pelvic-fin rays; skin of lower lip separated from lower jaw by a shallow groove; anal-fin base long, 90% of head length; no tubercles on snout.

The genus *Barbodes* has been considered the most primitive group in the Barbinae (Wu et al, 1977). Clarifying the taxonomy of those species in China is crucial for further study on the systematics and phylogeny of the Barbinae of China.

1 Materials and Methods

Chinese names of fishes follow Wu et al (1999). All specimens examined belong to the collections of Kunming Institute of Zoology (KIZ), the Chinese Academy of Sciences. Information on the specimens examined is listed in the following order: species name, catalog number of each specimen, total number of specimens observed, standard length range of specimens, and location. On some specimens, two labels are present. In such cases, the clearer one is listed as the catalog number and the other is listed in parentheses.

Barbodes baoshanensis, holotype and paratypes KIZ 839345, 799347, 8310188, 6411006; KIZ 6511013, 839346, 6 ex., 91 – 174 mm SL, Nu Jiang and Longchuan Jiang, Yunnan.

B. benasi, KIZ 60036 (00541), 60037, 775473, 775468, 4 ex., 117 – 166 mm SL, Yangjiang, Yunnan.

B. chonglingchengi, KIZ 636594, 7711013, 7811222, 8312535 – 6, 8312548 – 9, 8312552 – 3, 8312556, 841092, 11 ex., 125 – 244 mm SL, Lake Fuxian, Yunnan.

B. daliensis, KIZ 742130 – 1, 749976, 749979 – 80, 749982, 749985, 749987, 749989, 749991 – 2, 749994 – 6, 749997, 785108 – 9, 785112 – 8, 24 ex., 144 – 238 mm SL, Lake Erhai, Yunnan.

B. exiguus, KIZ 749983, 1 ex., 109 mm SL, Lake Erhai, Yunnan.

B. fuxianhuensis, KIZ 636431, 636497, 7711014, 8312511 – 3, 8312520 – 1, 8 ex., 146 – 266 mm SL, Lake Fuxian, Yunnan.

B. heterostomus, paratypes KIZ 764409, 764231, 7801064; KIZ 7801065, 764227, 764230, 764232, 764264, 764289, 764380, 764410 – 11, 765489 – 91, 7801062, 7801066, 17 ex., 97 – 236 mm SL, Longchuan Jiang and Daying Jiang, Yunnan.

B. huangchuchieni, KIZ 00649 – 51, 2003, 592081, 6015015, 6507113, 734053 – 4, 734085, 735013, 735076, 736169, 736171 – 2, 736174, 736176, 736178, 736180, 736206, 736208, 737002 – 5, 745027, 745048, 745120 – 7, 745131, 839247, 839252, 839254, 839257, 839280 – 1, 863547, 863550, 863553, 863559 – 60, 866100, 866110, 866129, 866139, 8840006, 8840025, 9107029, 96061108, 21 No number, 76 ex., 67 – 202 mm SL, Lancang Jiang; KIZ 605063 – 4, 605067, 605069, 605070 – 1, 605076, 605078, 6440470 – 1, 6450175, 6450179, 645313, 645323, 645537, 775409, 775481 – 2, 775485, 775487 – 8, 775491, 775493, 775495 – 6, 745499, 775500, 846313 – 4, 854003, 8540264, 30 ex., 70 – 159 mm SL, Yuan Jiang, Yunnan.

B. laticeps, KIZ 9907001, 1 ex., 81 mm SL, Huishui, Guizhou.

B. margaritanus, KIZ 764250, 764252 – 3, 764256, 764258, 764261, 764356, 764416, 765527 – 36, 8310404, 19 ex., 74.7 – 181 mm SL, Longchuan Jiang and Daying Jiang, Yunnan.

B. opisthopterus, KIZ 8110101, 799348, 2 ex., 175 – 186 mm SL, Nu Jiang, Yunnan.

B. parvus, KIZ 734153 – 5, 3 ex., 50 – 52 mm SL, Lancang Jiang, Yunnan.

B. rhomboides, KIZ 645616, 645621, 655036, 3 ex., 161 – 220 mm SL, Yuan Jiang, Yunnan.

B. shanensis carinatus, KIZ 6035001 – 2, 6035004 – 5, 6035009 – 11, 6035013 – 4, 9 ex., 120 – 310 mm SL, Lancang Jiang, Yunnan.

B. vernayi, KIZ 592119, 734064, 734092, 735078 – 80, 735187 – 8, 7890595, 736081, 736192 – 4, 736202 – 3, 745077 – 9, 745081, 7890595, 813041, 863537 – 9, 863541 – 2, 8640012, 27 ex., 60 – 240 mm SL, Lancang Jiang, Yunnan.

2 Results and Discussions

From 1981 until now, Rainboth proposed a new taxonomy system with several new genera, such as *Neolissochilus* Rainboth, 1985, *Hypsibarbus* Rainboth, 1996a, *Discherodontus* Rainboth, 1989, etc. This system has been adopted by many ichthyologists (Eschmeyer, 2003; Kottelat, 1989, 2001a, b; Roberts, 1998; Doi, 1997; Banarescu, 1997). Rainboth puts all the carps and barbs in Cyprininae, instead of separating them into two distinct subfamilies as has been done by Chinese ichthyologists (Fang, 1936; Chen & Huang, 1977). Fishes with an osseous last unbranched anal ray were assigned to sub-

family Cyprininae, while those with non-osseous last unbranched anal ray were assigned to subfamily Barbiinae (Chen & Huang, 1977). Within the Cyprininae (Rainboth, 1996b), there are many tribes. We mainly discuss the Cyprinini and Systomini here. The main characters of these two tribes and their subtribes are from Rainboth (1996b):

Cyprinini: 2 pairs of barbels. Eyes in upper part of head.

Cyprini: Dorsal spine serrated, branched dorsal ray 15, anal fin spine serrated.

Tores: Dorsal spine non-serrated, branched dorsal ray 10 or fewer. Systomini: 2 pairs of barbels or fewer. Dorsal fin spine serrated or smooth. Mouth terminal or subterminal.

Osteobrama: Scale radii appearing as a simple fissure, parallel or diverging, but not reaching the scale focus. No distinct border between lower lip and low jaw. Lower lip not reduced medially. Lower jaw never develops a sharp, keratinous edge.

Semiploti: Scale radii appearing as simple fissures, parallel or diverging, but not reaching the scale focus. Low lip, when present, separated from lower jaw by well-marked furrow. Lower lip often reduced or absent medially. Some forms with a sharp, keratinous edge on the lower jaw.

Systomi: Scale radii straight, their margins with heavy tissue deposition, diverging spoke-like from the scale focus. Lower lip always complete. Lower jaw never developing a keratinous edge.

After examining all the "*Barbodes*" fishes included in this research, we agree with the ideas of Kottelat (1999): "*Barbodes* is a name which has been used in the literature for a variety of cyprinid fishes. It has long been ignored for Southeast Asian species until revived for a genus of moderately large barbs by Rainboth (1981). It has also been used in China for a composite assemblage of species more or less equivalent to *Puntius sensu lato* of earlier authors".

The assignment of species previously named as *Barbodes* in Chinese literature are as follows:

2.1 *Neolissochilus*

B. baoshanensis, *B. benasi* and *B. heterostomus*, 2 pairs of barbels, eyes in upper part of head, dorsal spine smooth, branched dorsal rays 9 – 10. These characteristics assign these three species to the subtribe Tores. They also share following characters: ① large sclaes, fewer than 32 in lateral line; ② circumpeduncular scales 10 – 12; ③ two pairs of barbels; ④ facial tubercles, when present, confined to sides of snout. *Neolissochilus* has fewer than 30 lateral line scales and 12 circumpeduncular scales (Rainboth, 1985). *B. baoshanensis* in the Nu Jiang and Longchuan Jiang and *B. heterostomus* in the Irrawaddy have 10 – 12 circumpeduncular scales, and *B. benasi* in Yuan Jiang has 32 lateral line scales. Except for the variation

mentioned above, all three species in China are quite congruent with characters of the genus *Neolissochilus*, so they are assigned to *Neolissochilus*. *B. benasi* was already listed in the original description of the genus as a species of *Neolissochilus*, which was followed by Kottelat (2001a); the two other species are new combinations, *Neolissochilus baoshanensis* and *Neolissochilus heterostomus*.

Neolissochilus baoshanensis (Chen et Yang, 1999) new combination

Barbodes baoshanensis Chen et al, 1999: 82 – 88 (type localities: Nu Jiang in Baoshan; Nanding River at Boshang, Lingcang; Longchuan Jiang at Longchuan, Yunnan).

Barbodes (*Barbodes*) *wynaadensis*, Wu et al, 1977: 238 – 239 (non Day, 1873; type locality: main stream of Nu Jiang in Baoshan, Yunnan).

Barbodes wynaadensis, Chu & Cui, 1989: 183 – 184 (type locality: Nu Jiang in Daojie, Baoshan, Yunnan).

Barbodes wynaadensis, Chen, 1998: 146 – 147 (Baoshan, Yunnan).

Barbodes wynaadensis, Shan et al, 2000: 16 – 17 (Daojie, Baoshan, Yunnan).

Remarks The population in Yunnan is different from *B. wynaadensis* in both distribution and morphology (Chen et al, 1999). The present observation confirms that there is no consistent difference between populations in Nu Jiang and Longchuan Jiang.

Neolissochilus benasi (Pellegrin et Chevey, 1936)

Crossochilus benasi Pellegrin et Chevey, 1936: 226 – 227 (type locality: Riviere Ngoi Pho Tao at Muong Hum, Lao Kay Prov., Tonkin and Riviere de Chapa at Pont des Lianes, Lao Kay Prov., Tonkin).

Crossochilus benasi, Chevey & Lemasson, 1937: 46.

Crossocheilus benasi, Mai, 1978: 102.

Neolissochilus benasi, Rainboth, 1985: 31 (Riviere Ngoi Pho Tao at Muong Hum, Lao Kay Prov., Tonkin and Riviere de Chapa at Pont des Lianes, Lao Kay Prov., Tonkin).

Barbodes benasi, Chu & Cui, 1989: 181 (Yuan Jiang at Hekou and Xichou, Honghe, Yunnan).

Barbodes benasi, Shan et al, 2000: 15 – 16. (Hekou and Xichou, Yunnan).

Neolissochilus benasi, Kottelat, 2001a: 31.

Remarks The species is considered as *Neolissochilus* by Rainboth (1985). Our results confirm that this species in China belongs to *Neolissochilus*.

Neolissochilus heterostomus (Chen et Yang, 1999)

Barbodes heterostomus Chen et al, 1999: 82 – 88 (type localities: Dayin Jiang at Nabang, Mangyun and Jiucheng, Yinjiang; Longchuan Jiang, Dehong, Yunnan).

Barbodes (*Barbodes*) sp. Wu et al, 1977: 239 – 240 (type locality: Yaluzangbu Jiang at Motuo, Tibet).

Barbodes hexagonolepis, Chu & Cui, 1989: 184 (non McClelland, 1839; type localities: Dayin Jiang at Nabang, Jiucheng and Mangyun, Yinjiang, Dehong; Longchuan Jiang at Tuantian, Qushi, Tengchong, Baoshan, Yunnan).

Barbodes hexagonolepis, Chen, 1998: 147.

Barbodes hexagonolepis, Shan et al, 2000: 19–20 (Nabang, Jincheng and Mangyun, Yijiang; Tuantian and Qushi, Tengchong, Yunnan).

Remarks The populations in Yaluzangbu Jiang at Motuo, Tibet, have been considered conspecific with the populations in Dayin Jiang and Longchuan Jiang, Yunnan, by most of Chinese authors. This assignment is supported by this research. The populations in Yaluzangbu Jiang are distributed in the upper reaches of the Brahmaputra River while *Neolissochilus hexagonolepis* occurs in the lower reaches of the same river. During this research, two more differences were discovered between *N. heterostomus* in Yunnan and Tibet and *N. hexagonolepis* in India by comparing our observations and the description of Talwar & Jhingran (1992): mouth rounded in *N. heterostomus* vs. truncate in *N. hexagonolepis*; lower jaw edge without a horny sheath in *N. heterostomus* vs. with a sharp horny sheath in *N. hexagonolepis*.

2.2 *Discherodontus*

B. parvus, 2 pairs of barbels, dorsal spine serrated, mouth subterminal, scale radii appear as a simple fissure, parallel or diverging, some radii reaching the scale focus, no obvious border between lower lip and lower jaw, lower lip not reduced medially, lower jaw without a keratinous edge. Except for the differences between our observations and the description in Rainboth (1996b), *B. parvus* should be assigned in the subtribe Osteobrama. It is also diagnosed by the following characters: ① 8 branched pelvic-fin rays; ② tip of dorsal-fin darkened; ③ pharyngeal teeth in 2 rows. This species is quite congruent with characters of *Discherodontus* (Rainboth, 1989, 1996b; Kottelat, 2001b), and Kottelat (2001b) already applied a new combination, *Discherodontus parvus* for this species; consequently *B. parvus* in China should be assigned as *Discherodontus parvus* as well.

Discherodontus parvus (Wu et Lin, 1977)

Barbodes (*Barbodes*) *parva* Wu et Lin, in Wu et al, 1977: 243–244 (type locality: Lancang Jiang at Jinghong, Yunnan).

Barbodes parva, Chu & Cui, 1989: 191 (Jinhong, Yunnan).

Barbodes parvus, Chen et al, 1999: 83.

Barbodes parva, Shan et al, 2000: 26–27 (Jinhong, Yunnan).

Discherodontus parvus, Kottelat, 2001b: 49 (Xishuangbanna, Yunnan).

2.3 *Hypsibarbus*

B. vernayi and *B. pierrei*, 2 pairs of barbels, dorsal spine serrated, mouth subterminal, scale radii

appear as simple fissure, parallel or diverging, some radii reaching the scale focus, lower lip separated from lower jaw by an obvious groove, lower lip reduced medially, lower jaw without a keratinous edge. Except for the differences between our observations and the description of Rainboth (1996a, b), they should be assigned in subtribe Semiploti. In our observation, they also share following characters: ① 8 branched dorsal-fin rays; ② anal-fin base 40%–60% of head length; ③ black scale margins give a reticulated color pattern. In Rainboth (1996b), *Hypsibarbus* has an anal-fin base length that is 60% of head length, which is different from our observation. In the description of Kottelat (2001b), *Hypsibarbus* also has the following characters: scales with a moderate number of parallel posterior radii and no or few lateral ones; body plain, without bars, blotches or spots, sometimes with a reticulate pattern; no dark blotch at tip of dorsal; snout length about equal to eye diameter. Rainboth (1996a) applied some characters to distinguish *Hypsibarbus* from *Poropuntius* and *Barbodes*, which are seldom used by Chinese authors, tiny sparse tubercles on snout, snout length approximately equal to orbit width, naris at posterior half of snout, intestine loops 6–7, scale focus location at middle third, scale height larger than length, scale rows between vent and anal-fin 1–2, scale melanin marginal, etc. Our observation is quite congruent with these characters above. Furthermore, *B. vernayi* and *B. pierrei* were already treated as *Hypsibarbus vernayi* and *Hypsibarbus pierrei* by Rainboth (1996a, b) and Kottelat (2001b). Therefore, *B. vernayi* and *B. pierrei* in China should be assigned to genus *Hypsibarbus* as well.

Hypsibarbus vernayi (Norman, 1925)

Barbus vernayi Norman, 1925: 315 (type locality: Thailand).

Barbodes (*Barbodes*) *daruphani luosuoensis* Wu et Lin, in Wu et al, 1977: 244–245 (Luosuojiang, Yunnan).

Barbodes vernayi, Chu & Cui, 1989: 192 (Xishuangbanna, Yunnan).

Barbodes vernayi, Chen et al, 1999: 84.

Hypsibarbus vernayi, Kottelat, 2001b: 57.

Barbodes pierrei (non Sauvage), Chu & Cui, 1989: 194 (Jinhong, Yunnan).

Barbodes pierrei (non Sauvage), Chen et al, 1999: 84.

Barbodes pierrei (non Sauvage), Shan et al, 2000: 29–30 (Jinhong, Yunnan).

Remarks Mainly based on an illustration of a specimen of *B. pierrei* from Yunnan (Chu & Cui, 1989), Rainboth (1996a) considered it to be a morphological

intermediate between *Hypsibarbus ananmensis* and the Burmese members of *Hypsibarbus*. Actually, the specimens of "*B. pierrei*" from Yunnan are quite different from *H. ananmensis* except in lepidology: Body depth 37% – 43% of SL in "*B. pierrei*" vs. 35.0% – 35.4% in *H. ananmensis*, head length 25.6% – 27.8% of SL vs. 21.3% – 22.7%, dorsal spine serrations 13 – 14 vs. 26 – 28. The primary features proposed to distinguish "*B. pierrei*" and *H. vernayi* (Chu & Cui, 1989) are circumferential scales 22 vs. 20 and upper transverse scales 5.5 vs. 4.5. After rechecking some medium-size specimens of *H. vernayi* from different collections, we found that variation existed in these characters, circumferential scales 20 or 22, upper transverse scales 4.5 or 5.5. Although "*B. pierrei*" has a paler humeral band and lighter reticulated network color pattern on the body than *H. vernayi* and, in most specimens, the pectoral-fin reaches or surpasses pelvic-fin origin vs. not reaching the pelvic-fin origin, we consider the specimens identified as "*B. pierrei*" in Yunnan to be a population of *H. vernayi*. The combined *H. vernayi* in Yunnan has 20 or 22 circumferential scales, 4.5 or 5.5 upper transverse scales, 26 – 32 lateral-line scales, 14 circumpeduncular scales and 12 – 16 dorsal spine serrations. *H. vernayi*, as diagnosed by Rainboth (1996a) has 20 or 22 circumferential scales, 5 or 6 upper transverse scales, 26 – 29 lateral-line scales, 14 circumpeduncular scales and 12 – 21 dorsal spine serrations. The specimens in Yunnan match well the description of *H. vernayi*. Because the specimens in Yunnan are collected from the most northern populations, a few more lateral-line scales are reasonable.

2.4 *Poropuntius*

All the other "*Barbodes*" fishes, *B. fuxianhuensis*, *B. chonglingchungi*, *B. margaritanus*, *B. huangchuchieni*, *B. daliensis*, *B. rhomboides*, *B. shanensis carinatus*, *B. opisthopterus* and *B. exiguus*, 2 pairs of barbules, dorsal spine serrated, mouth subterminal, scale radii appear as simple fissure, parallel or diverging, some radii reach the scale focus, lower lip separated from lower jaw by an obvious groove, lower lip reduced medially, lower jaw without a keratinous edge. Clearly, they should be assigned to the subtribe Semiploti. They also share following characters: ① 8 branched pelvic-fin rays; ② tip and sides of snout usually covered with tubercles (Rainboth, 1996b); ③ a black or dark stripe along margin of each caudal-fin

lobe, rest of caudal-fin hyaline to yellow; ④ lateral line tubes long, with pore on main canal on posterior half to quarter of scale and an accessory pore on a ventral branch at anterior edge of exposed scale (sometimes on nearly all scales, but sometimes on only a few, or indistinct) (Kottelat, 2001b). In our observation, characters ①, ②, and ③ are present in all of the species. All have an accessory ventral branch on at least a few lateral-line scales. Most of our observations of this group are congruent with description of Rainboth (1996b) and Kottelat (2001b), so all the fishes of this group should be assigned to the genus *Poropuntius*. Among them, a new combination of *Poropuntius carinatus* was already applied by Kottelat (2001b) in place of *B. shanensis carinatus*; *B. daliensis* was identified as a species of *Poropuntius*, and took as a junior synonym of *B. cogginii* (Roberts, 1998); *B. rhomboides* was considered to be a species of *Poropuntius* (Kottelat, 2001a; Roberts, 1998) and was treated as a junior subjective synonym of *Poropuntius alloiopterus* (Vaillant) 1893. Until we have the opportunity to compare specimens of *Poropuntius rhomboides* in Yunnan to *P. alloiopterus* in Vietnam, we temporarily treat *P. rhomboides* as valid. Three new combinations of *Poropuntius margaritanus*, *Poropuntius exigua*, and *Poropuntius opisthoptera* were already applied by Roberts (1998). The remaining three Chinese endemic fishes are herein placed into new combinations: *Poropuntius fuxianhuensis*, *Poropuntius chonglingchungi* and *Poropuntius huangchuchieni*.

Poropuntius carinatus (Wu et Lin, 1977)

Barbodes (*Barbodes*) *shanensis carinatus* Wu et Lin, in Wu et al, 1977: 240 (type locality: Salween at Meng'a, Yunnan).

Barbodes shanensis carinatus, Chu & Cui, 1989: 185 (Lancang Jiang at Meng'a, Yunnan).

Barbodes shanensis carinatus, Chen et al, 1999: 83 (Lancang Jiang, Yunnan).

Barbodes carinatus, Shan et al, 2000: 20 – 21 (Lancang Jiang, Yunnan).

Poropuntius carinatus, Roberts, 1998: 122 (Salween basin, Yunnan).

Poropuntius carinatus, Kottelat, 2001b: 69 (Xishuangbanna; Salween basin in Yunnan).

Remarks Chu & Cui (1989) pointed out Meng'a belonged to Lancang Jiang basin instead of Salween basin, the type locality in Wu et al (1977) was a writing/printing error. It is obvious Roberts (1998) did not notice this correction. Roberts (1998) considered that the dorsal ridge (keel) might be due to poorly fed

condition of the syntypes or an artifact of preservation. In our observation, a prominent dorsal ridge is present in all specimens of *P. carinatus* and *P. rhomboides*, a non-prominent one also present in *P. opisthopterus* and *P. huangchuchieni*. We believe the dorsal ridge is a natural feature of these fishes and not an artifact as proposed by Roberts (1998).

***Poropuntius chonglingchungi* (Tchang, 1936) new combination**

Barbus chonglingchungi Tchang, 1936: 63 (type locality: Yunnan).

Barbodes (Barbodes) lacustris Wu et al, 1977: 245 (type locality: Lake Fuxian, Yunnan).

Barbodes chonglingchungi, Chu & Cui, 1989: 186 (Lake Fuxian).

Puntius pachygnathus Wang, Zhuang et Gao, 1982: 216 (type locality: Lake Fuxian, Yunnan).

Barbodes chonglingchungi, Yang, 1991: 195.

Barbodes chonglingchungi, Yang & Chen, 1995: 80.

Barbodes chonglingchungi, Chen et al, 1999: 83.

Barbodes chonglingchungi, Shan et al, 2000: 21–23.

Remarks This species match well the characteristics of genus *Poropuntius*.

***Poropuntius cogginii* (Chaudhuri, 1912)**

Barbus cogginii Chaudhuri, 1912: 16, pl. 1, Fig.2 (type locality: Lake Tali Fu = Lake Erhai, Yunnan).

Barbus gregori Norman, 1923: 562 (type locality: Yunnan).

Barbus cogginii, Rendahl, 1928: 138 (Lake Erhai); but see Roberts, 1998.

Barbus yunnanensis Fowler, 1958.

Barbus cogginii Cheng, 1949: 528 (type locality: Lake Erhai).

Barbus cogginii, Cheng, 1958: 157.

Barbus susanae Banister, 1973.

Barbodes (Barbodes) daliensis Wu et Lin, in Wu et al, 1977: 249–250 (type locality: Lake Erhai).

Barbodes daliensis, Chu & Cui, 1989: 200.

Barbodes daliensis, Chu & Zhou, 1989: 10.

Barbodes daliensis, Chen, 1998: 151.

Poropuntius cogginii (Chaudhuri), Roberts, 1998: 112–113.

Poropuntius gregorii (Norman), Roberts, 1998: 113.

Barbodes daliensis, Chen et al, 1999: 84.

Barbodes daliensis, Shan et al, 2000: 35–36.

Remarks There are two common features shared by *B. cogginii* and *B. exiguus*: sexual maturity at a small size and eye diameter equal to snout length. These two shared characters were supported Chu & Cui (1989) who considered it was possible that *B. cogginii* was the synonym of *B. exiguus*. Roberts (1998) considered *B. daliensis* was a validly described species, and identified it as a species of *Poropuntius*, then further took it as a junior synonym of *B. cogginii*. He also pointed out “it is readily distinguished from all other *Poropuntius* except *P. exigua* by its relatively smaller fins, particularly the caudal-fin”. In the description

of *B. (B.) daliensis*, this new name is more likely a replacement name for *Barbus gregori*, and *B. cogginii* was obviously considered as a synonym of this nominal new species. However, as proposed by Roberts (1998), the older name *Barbus cogginii* should be restored and treat *B. (B.) daliensis* as a junior synonym of *B. cogginii*.

***Poropuntius exiguus* (Wu et Lin, 1977)**

Barbodes (Barbodes) exigua Wu et Lin, in Wu et al, 1977: 249 (type locality: Xizhou, Lake Erhai, Yunnan).

Barbodes exigua, Chu & Cui, 1989: 198.

Barbodes exigua, Chen, 1998: 150.

Poropuntius exigua, Roberts, 1998: 122–123.

Barbodes exiguus, Chen et al, 1999: 84.

Barbodes exigua, Shan et al, 2000: 33–35.

Remarks We agree with Roberts's conclusion (1998) that this species is valid. At present, this species is endangered as are other endemic fishes in Lake Erhai because it has not been collected for many years and we think this species is most likely extinct already. Given the gender of this genus is masculine, the correct species name should be *exiguus* instead of a feminine name *exigua*.

***Poropuntius fuxianhuensis* (Wang, Zhuang et Gao, 1982) new combination**

Puntius fuxianhuensis Wang, Zhuang et Gao, 1982: 217 (type locality: Lake Fuxian, Yunnan).

Barbodes fuxianhuensis, Chu & Cui, 1989: 188 (Lake Fuxian, Yunnan).

Barbodes fuxianhuensis, Yang, 1991: 196.

Barbodes fuxianhuensis, Yang & Chen, 1995: 80.

Barbodes fuxianhuensis, Chen et al, 1999: 83.

Barbodes fuxianhuensis, Shan et al, 2000: 23–24.

Remarks As with *P. chonglingchungi*, this species match well the characteristics of genus *Poropuntius*.

***Poropuntius huangchuchieni* (Tchang, 1962) new combination**

Barbus huangchuchieni Tchang, 1962: 96–97 (type locality: Lancang Jiang at Mengla of Xishuangbanna, Yunnan).

Barbodes (Barbodes) huangchuchieni, Wu & Lin, in Wu et al, 1977: 250–251 (Jinhong, Yunnan).

Barbodes huangchuchieni, Chu & Cui, 1989: 201 (Lancang Jiang and Yuan Jiang, Yunnan).

Barbodes huangchuchieni, Chen, 1998: 153 (Baoshan; Yangbi, Yunnan).

Barbodes huangchuchieni, Chen et al, 1999: 83 (Lancang Jiang and Yuan Jiang).

Barbodes huangchuchieni, Shan et al, 2000: 36–37 (Lancang Jiang and Yuan Jiang).

Remarks *B. huangchuchieni* and *Acrossocheilus krempfi* have been considered as two distinct species by Wu et al (1977), Chu & Cui (1989) and followed by many Chinese ichthyologists until now. Kottelat

(2001a) mentioned, "at least part of the *Acrossocheilus krempfi* of Chu & Cui (1989) are misidentified". During this research, we also found this mistake and confirmed the observation of Kottelat (2001a). One specimen labeled as *A. krempfi* from Malipo, 1977 a whole jar of specimens labeled as *A. krempfi* from Xichou, Wenshan, 1977 and one specimen labeled as *A. krempfi* from Simaogang, 1996 actually are *P. huangchuchieni*.

The reverse circumstance also exists. Kottelat (2001a) pointed out that the Yuan Jiang specimens of *B. huangchuchieni* are possibly *Poropuntius krempfi*. It "belongs to genus *Poropuntius* as revealed by the examination of the holotype (Kottelat, 1998)". We found one whole jar of specimens labeled as *B. huangchuchieni* from Hekou, Honghe, 1960 are *A. krempfi*. *B. huangchuchieni* is also confirmed belonging to genus *Poropuntius* in this research. According to our observation, specimens of *P. huangchuchieni* and *P. krempfi* share the following characters: a black blotch on caudal-fin base, black stripe along margin of each caudal lobe, lateral line scale number, predorsal scale number, circumpeduncular scale number, scale above and below later line number, gill rakers number; meanwhile they are different in the following characters: lower lip not reduced medially or slightly reduced in *P. huangchuchieni* vs. lower lip prominently reduced medially, anterior edge of lower jaw with keratinous edge in some specimens in *P. krempfi*; distance between corners of mouth larger than eye diameter in *P. huangchuchieni* vs. the distance smaller than or equal to diameter in *P. krempfi*. This evidence refutes the conclusion of Kottelat (2001a) and suggests *P. huangchuchieni* and *P. krempfi* are two distinct species.

Kottelat (2001a) also proposed that it was possible that *P. huangchuchieni* was a senior synonym of *P. carinatus*. Our results show that they are distinct species: back curved and belly straight; sides of body with a slightly dark band; distance between dorsal-fin origin and caudal-fin base almost equal to distance between dorsal-fin origin and posterior margin of eye in *P. carinatus* vs. back and belly curved almost to the same degree; no dark band along sides of body; distance between dorsal-fin origin and caudal-fin base almost equal to distance between dorsal-fin origin and snout tip in *P. huangchuchieni* (Chen et al, 1999).

P. huangchuchieni is found in Lancang Jiang and

Yuan Jiang. Kottelat (2001a) mentioned "Chu and Cui record the species from Wenshan and Xichou in the Lo River basin and from Xishuangbanna in the Mekong basin and it seems likely that these are not conspecific". In this research we measured 47 external characters of 44 specimens from Lancang Jiang and 25 specimens from Yuan Jiang, the coefficients of difference (CD) of 51 ratio from the 47 characters were calculated. The results show that the CDs vary from 0.01 to 0.83, no one larger than the threshold of subspecies (1.28). Therefore, no morphological evidence supports the hypothesis that *P. huangchuchieni* has differentiated into two subspecies. The hypothesis of Kottelat (2001a) may be right but needs to be testified in a, most likely, molecular research in the future.

***Poropuntius margarianus* (Anderson, 1879)**

Barbus margarianus Anderson, 1879: 867, pl. 79 (Fig. 1) (type locality: Nampoung River, Kakhien hills, near Bhamo, Irrawaddy basin); but see Eschmeyer, 2003.

Barbodes (*Barbodes*) *margarianus* (Anderson), Wu et al, 1977: 242 (Taiping Jiang, Yunnan).

Barbodes margarianus (Day), Chu & Cui, 1989: 196 (Mangshi; Jiucheng, Mangyun, Nabang of Yinjiang; Tuantian of Tengchong, Yunnan).

Barbodes margarianus (Anderson), Chen, 1998: 149.

Poropuntius margarianus (Anderson), Roberts, 1998: 111.

Barbodes margarianus (Day), Chen et al, 1999: 84.

Remarks Chu & Cui (1989) mentioned that in the preface of Anderson (1879), the fish part was written by Day, therefore the namer of this species should be Day instead of Anderson. Eschmeyer (2003) confirms the fish descriptions were written by Anderson. *B. margarianus* occurs in Longchuan Jiang and Daying Jiang, its types were collected in Nampoung River. Chu & Cui (1989) considered this river is a tributary of Daying Jiang. They also considered this species has no obvious differences from the description of *Barbus clavatus* McClelland, 1845 and was repeatedly reported from the Irrawaddy River at Myitkyina, Myanmar, which is adjacent to Yunnan, China, so this species is probably a synonym of *Barbus clavatus*. We checked the description of *Barbus clavatus* (Talwar & Jhingran, 1992) and found three major differences between *Barbus clavatus* and *Barbodes margarianus*: ① mouth terminal in *Barbus clavatus* vs. subterminal in *Barbodes margarianus*; ② rostral barbels "minute (often absent), and maxillary barbels small and about one-third of orbit" in *Barbus clavatus* vs. rostral barbels longer than orbit, extending posteriorly surpassing anterior edge of eye or even longer, and maxillary

reaching posterior edge of eye in *Barbodes margarianus*; ③ dorsal-fin “inserted nearer to snout-tip than to base of caudal-fin” in *Barbus clavatus* vs. inserted equidistant between anterior edge of eye or snout-tip and caudal-fin base, or even nearer to caudal-fin base than to snout-tip in *Barbodes margarianus*. Therefore, it is not likely that *Barbodes margarianus* is the synonym of *Barbus clavatus*. Roberts (1998) confirmed validity of this species as well as *B. clavatus* and assigned it as a new combination, *Poropuntius margarianus*.

Poropuntius opisthopterus (Wu, 1977)

Barbodes (*Barbodes*) *opisthoptera* Wu, in Wu et al, 1977: 246 (type locality: Nu Jiang at Huiyuanqiao and Baoshan, Yunnan).

Barbodes opisthoptera, Chu & Cui, 1989: 189 (Nu Jiang basin).

Barbodes opisthoptera, Chen, 1998: 148 (Nu Jiang basin).

Poropuntius opisthoptera, Roberts, 1998: 123.

Barbodes opisthopterus, Chen et al, 1999: 83 (Daojie of Baoshan, Yunnan).

Remarks Given the gender of this genus is masculine, the correct species name should be *opisthopterus* instead of a feminine name *opisthoptera*.

Poropuntius rhomboides (Wu et Lin, 1977)

Barbodes (*Barbodes*) *huangchuchieni rhomboides* Wu et Lin, in Wu et al, 1977: 248–249 (type locality: Yuan Jiang, Yunnan).

Barbodes rhomboides, Chu & Cui, 1989: 195 (Yuan Jiang, Yunnan).

Barbodes rhomboides, Chen et al, 1999: 84.

Barbodes rhomboides, Shan et al, 2000: 30–32 (Yuan Jiang at Hekou, Yunnan).

Poropuntius alioiopleurus (Vaillant) 1893, Kottelat, 2001a: 35–36.

Remarks This species was considered to be a species of *Poropuntius* (Kottelat, 2001a) and was treated as a junior subjective synonym of *Poropuntius alioiopleurus* (Vaillant) 1893 without strong evidence. Until we have the opportunity to compare specimens of *Poropuntius rhomboides* in Yunnan to *P. alioiopleurus* in Viet-

nam, we temporarily treat it as valid.

Conclusion: The species assigned to the genus *Barbodes* in China actually belong to at least four distinct genera: ① *B. baoshanensis*, *B. benasi* and *B. heterostomus* are assigned to the genus *Neolissochilus*; ② *B. parvus* is assigned to the genus *Discherodontus*; ③ *B. vernayi* is assigned to the genus *Hypsibarbus*; ④ *B. fuxianhuensis*, *B. chonglingchungi*, *B. margarianus*, *B. huangchuchieni*, *B. cogginii*, *B. rhomboides*, *B. carinatus*, *B. opisthopterus* and *B. exiguus* are assigned to the genus *Poropuntius*.

Acknowledgements: Dr. Carl Ferraris reviewed the manuscript and made a lot of corrections and improvement on the manuscript. Dr. Maurice Kottelat presented many helpful comments and a part of his still unpublished book as well as some reprints of published works related to this research. Dr. ZHANG E, Institute of Hydrobiology, the Chinese Academy of Sciences, helped in securing important literature and gave a lot of helpful criticism. We wish to express our thanks to Profs. CHEN Yin-rui, LI Zai-yun, CUI Gui-hua, Drs. SU Rui-feng, DAI Ying-gui, CHEN Zi-ming, Ms. WANG Li and Ms. FENG Qing, for their helps in many aspects of this study. We also wish to thank Profs. WANG Ying-xiang, YANG Da-tong, YANG Lan, Kunming Institute of Zoology, the Chinese Academy of Sciences, and Profs. ZAN Rui-guang, HE Ji-chang, Yunnan University, for their valuable comments. Special thanks are owed to Mr. David Catania, California Academy of Sciences for lots of help in literature retrieval and presenting some important literature. We thank all anonymous reviews of the manuscript for their valuable advice.

References:

- Banarescu P. 1997. The status of some nominal genera of Eurasian Cyprinidae (Osteichthyes, Cypriniformes) [J]. *Rev. Roum. Biol. Ser. Biol. Anim.*, 42 (1): 19–30.
- Banister K. 1973. A revision of the large *Barbus* (Pisces, Cyprinidae) of east and central Africa [J]. *Bull. Br. Mus. Nat. Hist. (zool.)*, 26 (1): 3–148.
- Bleeker P. 1859. Conspectus systematis cyprinorum [J]. *Nat. Tijds. Neder-Indie*, 200: 431.
- Chaudhuri BL. 1912. Contributions to the fauna of Yunnan based on collections made by J. Coggin Brown, B. Sc. Part 2. Fishes [J]. *Rec. Indian Mus.*, 6: 16.
- Chen XL, Huang HJ. 1977. Cyprininae [A]. In: Wu HW. 1977. The Cyprinid fishes of China. Shanghai: Vol. 2 [M]. Shanghai: Scientific Technical Press. 395–430. [陈湘萍, 黄宏金. 1977. 鲤亚科. 见: 伍献文. 1977. 中国鲤科鱼类志. 上海: 科技出版社: 395–430.]
- Chen XY, Yang JX, Chen YR. 1999. A review of the cyprinoid fish genus *Barbodes* Bleeker, 1859, from Yunnan, China, with descriptions of two new species [J]. *Zool. Studies*, 38 (1): 82–88. [陈小勇, 杨君兴, 陈银瑞. 1999. 云南四须鲃属 (*Barbodes*) 鱼类之分类整理及两新种描述. 动物学学报, 38 (1): 82–88.]
- Chen YR, Chu XL. 1985. Systematic study of the genus *Tor* (Pisces: Cyprinidae) with description of a new species [J]. *Zool. Res.*, 6 (1): 79–86. [陈银瑞, 褚新洛. 1985. 我国结鱼属鱼类的系统分类及一新种的记述. 动物学研究, 6 (1): 79–86.]
- Chen YY. 1998. The Fishes of the Hengduan Mountains Region [M]. Beijing: Science Press. 1–364. [陈宜瑜. 1998. 横断山区鱼类. 北京: 科学出版社. 1–364.]
- Cheng CT. 1949. Note sur les Poissons des eaux douces du Yunnan,

- Chine, des collection du Museum [J]. *Bull. Mus. Hist. Nat., Paris* (2), 21 (5): 528.
- Cheng CT. 1958. Fishes of Yunnan [J]. *Chinese Journal of Zoology*, 2 (3): 157.
- Chevey P, Lemasson J. 1937. Contribution a l'etude des poisons des eaux douces tonkinoises [J]. *Notes Inst. Oceanogr. Indochine*, 33: 1-183.
- Chu XL, Cui GH. 1989. Barbinae [A]. In: Chu XL, Chen YR. The Fishes of Yunnan, China. Part I [M]. Beijing: Science Press. 180-203. [褚新洛, 崔桂华. 1989. 鲃亚科. 见: 褚新洛, 陈银瑞. 云南鱼类志 (上册). 北京: 科学出版社. 180-203.]
- Chu XL, Zhou W. 1989. Fishes of Erhai [A]. In: Shen RX. Collected Works Scientific on Erhai Lake in Yunnan [C]. Kunming: Yunnan Nationalities Press. 1-30. [褚新洛, 周伟. 1989. 洱海的鱼类. 见: 沈仁湘. 云南洱海科学论文集. 昆明: 云南民族出版社. 1-30.]
- Doi A. 1997. A review of taxonomic studies of cypriniform fishes in Southeast Asia [J]. *Japan J. Ichthyol.*, 44 (1): 1-33.
- Eschmeyer W. 1998. The Catalog of Fishes [M]. San Francisco: California Academy of Sciences.
- Eschmeyer W. 2003. The Catalog of fishes on-line [OL/DB]. San Francisco: California Academy of Sciences.
- Fang PW. 1936. Chinese fresh-water fishes referring to Cyprininae [J]. *Sinensia*, 7 (6): 686-721.
- Fowler HW. 1958. Some new taxonomic names of fishlike vertebrates [J]. *Notul. Nat.*, (310): 1-16.
- Jayaram KC. 1981. The Freshwater Fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka — A Handbook [M]. Calcutta: Zoological Survey of India. 1-475.
- Kottelat M. 1989. Zoogeography of the fishes from Indochinese inland waters with an annotated check-list [J]. *Bull. Zool. Mus. Univ. Amsterdam.*, 12 (1): 1-54.
- Kottelat M. 1998. Fishes of the Nam Theun and Xe Bangfai basins, Laos, with diagnoses of twenty-two new species (Teleostei: Cyprinidae, Balitoridae, Cobitidae, Coiidae and Odontobutidae) [J]. *Ichthyol. Explor. Freshwaters*, 9: 1-128.
- Kottelat M. 1999. Nomenclature of the genera *Barbodes*, *Cyclocheilichthys*, *Rasbora* and *Chonerhinos* (Teleostei: Cyprinidae and Tetraodontidae), with comments on the definition of the first reviser [J]. *The Raffles Bull. Zool.*, 47 (2): 591-600.
- Kottelat M. 2001a. Freshwater Fishes of Northern Vietnam [M]. Environment and Social Development Sector Unit, East Asia and Pacific Region, The World Bank. 31-42.
- Kottelat M. 2001b. Fishes of Laos [M]. Colombo: Wildlife Heritage Trust Publications. 1-196.
- Lin RD, Zhang CG. 1986. Description of a new species of the barbinae genus *Barbodes* from China (Cypriniformes: Cyprinidae) [J]. *Acta Zootaxon. Sin.*, 11 (1): 108-110.
- Mai DY. 1978. Identification of Freshwater Fishes of Northern Viet Nam [M]. Ha Noi: Nha Xuat Ban Khoa Hoc Va Ky Thuat. 1-339. (in Vietnamese).
- Norman JR. 1923. Three new fishes from Yunnan, collected by Professor J. W. Gregory, FRS [J]. *Ann. Mag. Nat. Hist.*, 11: 561-563.
- Norman JR. 1925. Two new cyprinoid fishes of the genus *Barbus* from Nyasaland and Siam [J]. *Ann. Mag. Nat. Hist.*, 15 (9): 315.
- Pellegrin J, Chevey P. 1936. Poissons nouveaux ou rares du Tonkin et de l'Annam [J]. *Bull. Soc. Zool. Fr.*, 56: 226-227.
- Rainboth WJ. 1981. Systematics of the Asiatic barbinae (Pisces, Cyprinidae) [D]. Ph. D. Thesis, University of Michigan, Ann Arbor. 1-253.
- Rainboth WJ. 1985. *Neolissochilus*, a new genus of South Asian cyprinid fishes [J]. *Beaufortia*, 35: 25-35.
- Rainboth WJ. 1989. *Discherodontus*, a new genus of cyprinid fishes from southeastern Asia [J]. *Occ. Pap. Mus. Zool. Univ. Michigan*, 718: 1-31.
- Rainboth WJ. 1991. Cyprinid fishes of Southeast Asia [A]. In: Winfield IJ, Nelson JS. Cyprinid Fishes: Systematics, Biology and Exploitation [M]. London: Chapman and Hall. 156-210.
- Rainboth WJ. 1996a. The taxonomy, systematics, and zoogeography of *Hypsibarbus*, a new genus of large barbids (Pisces, Cyprinidae) from the River of Southeastern Asia [J]. *Univ. Calif. Publ. Zool.*, 129: i-xiii + 1-199.
- Rainboth WJ. 1996b. FAO Species Identification Field Guide for Fishery Purposes: Fishes of the Cambodian Mekong [M]. Rome: FAO. 1-265.
- Roberts TR. 1989. The freshwater fishes of western Borneo (Kalimantan Barat, Indonesia) [J]. *Mem. Calif. Acad. Sci.*, 14: i-xii + 1-210.
- Roberts TR. 1998. Review of the tropical Asian Cyprinid fish genus *Poropuntius*, with descriptions of new species and trophic morphs [J]. *Nat. Hist. Bull. Siam Soc.*, 46: 105-135.
- Shan XH. 2000. Revision of the genus *Puntius* (Hamilton) from China and discussion on some taxonomic uncertainty of this genus [J]. *Acta Zootaxonomica Sinica*, 25 (1): 114-115. [单乡红. 2000. 中国小鲃属的分类整理及小鲃属的分类学讨论. 动物分类学报, 25 (1): 114-115.]
- Shan XH, Lin RD, Yue PQ, Chu XL. 2000. Barbinae [A]. In: Yue PQ, et al. Fauna Sinica, Osteichthyes, Cypriniformes III [M]. Beijing: Science Press. 3-170. [单乡红, 林人端, 乐佩琦, 褚新洛. 2000. 鲃亚科. 见: 乐佩琦, 等. 中国动物志, 硬骨鱼纲, 鲤形目 (下卷). 北京: 科学出版社. 3-170.]
- Talwar PK, Jhingran AG. 1992. Inland Fishes of India and Adjacent Countries. vol. 1 [M]. India: A. A. Balkenma/Rotterdam. 265-266.
- Tchang TL. 1936. Notes on a new *Barbus* from Yunnan [J]. *Bull. Fan-Mem. Inst. Biol.*, 7: 63-64.
- Tchang TL. 1962. Name list of fishes in Xishuangbanna, Yunnan, and a new species [J]. *Acta Zool. Sin.*, 14 (1): 96-97. [张春霖. 1962. 云南西双版纳鱼类名录及一新种. 动物学报, 14 (1): 96-97.]
- Wang YH, Zhuang DD, Gao LC. 1982. Description on three new barbin fishes from lake Fuxianhu, Yunnan Province [J]. *Acta Zootaxonomica Sinica*, 7 (2): 216-222. [王幼槐, 庄大栋, 高礼存. 1982. 云南抚仙湖鲃亚科鱼类三新种. 动物分类学报, 7 (2): 216-222.]
- Wu HL, Shao GZ, Lai CF. 1999. Latin-Chinese Dictionary of Fishes Names [M]. Jilong: Fishery Press. 1-1028. [伍汉霖, 邵广昭, 赖春福. 1999. 拉汉世界鱼类名典. 基隆: 水产出版社. 1-1028.]
- Wu HW, Lin RD, Chen JX, Che XL, He MJ. 1977. Barbinae [A]. In: Wu HW. The Cyprinid Fishes of China. Vol. 2 [M]. Shanghai: Scientific Technical Press. 236-252. [伍献文, 林人端, 陈景星, 陈湘舜, 何名巨. 1977. 鲃亚科. 见: 伍献文. 中国鲤科鱼类志 下卷. 上海: 科技出版社. 236-252.]
- Yang JX. 1991. The fishes of Fuxian lake, Yunnan, China, with description of two new species [J]. *Ichthyol. Explor. Freshwaters*, 2 (3): 195-196.
- Yang JX, Chen YR. 1995. The Biology and Resource Utilization of the Fishes of Lake Fuxian, Yunnan [M]. Kunming: Yunnan Science and Technology Press. [杨君兴, 陈银瑞. 1995. 云南抚仙湖鱼类生物学和资源利用. 昆明: 云南科技出版社.]